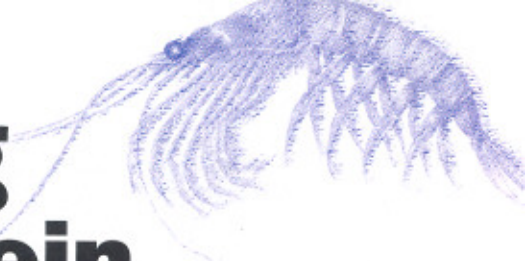


# The building blocks of protein



*In this and in upcoming issues of Feed Tech Dr Joachim Hertrampf will elaborate on items that affect shrimp farming and feeding, which he frequently writes about as a consultant in the monthly newsletter "Shrimp Matters", of The Waterbase in Chennai, India. In his first contribution of this serial protein is taken into the spotlight.*

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**T**he most important nutrient for shrimps is protein. The basic units of protein are amino acids. There are some twenty major amino acids, subdivided into essential, semi-essential and non-essential amino acids.

There are ten essential amino acids that cannot be synthesised by shrimps (arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine). They have to be provided for through the feed. For the complete utilisation of the dietary protein, the essential amino acids have to be balanced. This means that the level of the individual amino acids have to follow a certain ratio. Shortage of one amino acid affects the utilisation of the other amino acids. The overall utilisation of all amino acids is dependent on the least available amino acid.

This theory can be demonstrated by the amino acid barrel. Picture a barrel with staves of varying lengths, sitting upright on one end. The length of the staves indicates the amount of each amino acid present. If this barrel is filled with water, the water level inside is determined by the shortest stave of the barrel. There is no point in having other longer staves because the water will always leak out of the barrel at the level of the shortest stave. For instance, if lysine is the shortest stave of the amino acid barrel, all other amino acids are only utilised to the level of the lysine stave.

Although this sounds theoretical to a certain extent, it has practical significance. It means that excess dietary amino acids are not only costly, but also require energy for deamination. As well as being the building blocks of protein, amino acids are also involved in animal growth, maintenance of body tissues, and providing energy for the well-being of the animal.

### Amino acid profiles

Amino acids, which are likely to limit performance in

animals despite a diet containing adequate quantities of crude protein, are: lysine, threonine, methionine and tryptophan.

As an example, the protein of fish meal is considered as having the best balanced amino acid profile. Although fish meal has a surplus of most essential amino acids; it is nevertheless short in tryptophan and valine. Another protein raw material of interest is soybean meal. It is well known that soybean meal is short in methionine and lysine. But there is also a slight deficiency in threonine and valine with regard to the optimal amino acid balance.

The amino acid profile of meat and bone meal is poor. It is short in all of the considered amino acids.

### Availability

Even if the amino acid profile of protein raw materials is ideal, it is not a guarantee for best utilisation. There are a number of physiological reasons that the amino acids are not fully utilised by the animal. There can be a failure of the digestive tract to fully hydrolyse the protein. Another possibility is that the amino acids are not available at the time at the site of the protein synthesis in the animal.

Physical/technical matters may also affect the digestibility of amino acids (e.g. heating of fish meal and toasting of soybeans). Particularly lysine and methionine are affected by heating.

Unfortunately, there are no data on the amino acid availability in crustaceans. However, results from studies in pigs show that the relative availability of amino acids for most of the relevant raw materials ranges between 80% and 90%.

Sufficient crude protein of a shrimp feed is not a guarantee for optimal amino acid profile. The combination of the right raw materials for formulating an efficient shrimp feed is very important. This is a prerequisite for growth and well-being of the shrimps. ●